Environmental problems

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ENVIRONMENTAL PROBLEMS: MARKET-BASED SOLUTIONS

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INTRODUCTION

In April 1987, the World Commission on Environment and Development, chaired by Gro Harlem Brundtland of Norway, issued its report entitled "Our Common Future."(1) That report called for an integration of environmental considerations into the economic thinking and planning of industry and government. Rather than viewing environmental protection as a substitute for economic growth and development, the report argued that the two are inextricably linked and that good environmental policies mean good economic policies.

Such an integration makes a great deal of sense. One can indeed argue that an artificial dichotomy between the two is the origin of most, if not all, of our environmental problems. Excessive environmental pollution has come about because producers and consumers of polluting products have been able to impose external costs on third parties. By the internalizing of such external costs, economic and environmental decisions would be fully integrated.

Governments' traditional method of dealing with pollution-related problems has been to employ command and control (CAC) types of regulations, whereby firms and individuals are told how much pollutants they may emit, the type of technology to use, the goods they may produce, the production processes to employ, etc. Business firms complain about the high cost of meeting standards and the process by which new standards are

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(1) World Commission on Environment and Development, Our Common Future, Oxford University Press, Oxford, 1987.

put into place, which is long and drawn out and requires years of negotiation between politicians, bureaucrats and industry officials. Environmentalists complain that regulations are too slow in coming and are not tough enough.

Quite often, the basic philosophical premise of such controls is that any amount of pollution is unacceptable. Practical considerations, however, dictate that compromises must be made in the interim and a certain amount of pollution must be accepted, in the short run at least. In addition to the difficult decision as to the amount of pollution to allow, regulators must also determine the distribution of that allowable pollution by firm, industry and region. Often, regulators impose uniform proportionate reductions on all polluting firms.

Environmental decisions can become embroiled in a wide range of disputes about level fields of competition for industries, regional development, employment adjustment, etc. Not only do these considerations make the process of environmental decision-making more difficult, they may also distort the original aims of environmental policies.

An alternative to CAC regulation is one based upon market-related principles. To an economist, pollution is a problem of mis-allocated resources. The environment represents a good which people like to enjoy, as well as being an input into the production process; it is a valuable resource. By mispricing the environment, typically by setting a zero price for it, the environment is consumed too readily and the means which would preserve it are used too sparingly. Thus, we have too much pollution. In this sense, good economic policies mean good environmental policies.

A market-based approach, like CAC types of regulation, is only another possible instrument of public policy. Economists believe it to be a more efficient instrument, which would deliver the same level of environmental cleanliness as a CAC regulation, but at lower cost. But the state of the environment also depends upon the goals of policymakers and the parameters they then assign to them. A government which has no concern about the environment will establish low values for its environmental policies, resulting in weak CAC regulations or low market prices for the

use of the environment under a market-based scheme. In such a situation, one must be careful not to blame the instrument for the failure of the policy.

MARKET-BASED SOLUTIONS

A. Description

To a firm, the environment represents a factor of production. The demand for this factor looks very much like the demand for any other factor of production, such as labour, land and capital - it is a declining function of price (the quantity demanded declines as the price rises). If the environment is offered to producers at a zero price, they will use it in large quantities. For a producer, using the environment as a factor of production often means using it as a receptacle for garbage(2) of one sort or another. The alternatives, reducing the production of garbage or disposing of it properly, are costly because they require the use of labour, capital and other inputs for which the firm must pay. The producer weighs the costs of these alternatives against the price of using the environment, which at the moment is often zero.

A market-based solution to environmental problems would establish some positive price for the use of the environment and then have firms use that price in determining the amount of pollution that they will emit. If the price has been set properly, then the optimal quantity of pollution will result. Environmentalists often complain of greedy and rapacious capitalists who plunder the environment, and in some sense they are right. The environment is only plundered, however, because it is offered to firms as a valueless commodity. A market-based approach would use the producer's profit motive to reduce the level of pollution by

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(2) Here we use the term garbage to refer to any secondary output of a firm which may harm the environment. It includes emissions into the air or water, accidental spillages and waste which must be somehow disposed of.

charging a valid price for using the environment, rather than the zero price which firms have been accustomed to.

The government can use a number of ways to introduce measures that ultimately set a price for the environment. It can establish a discharge fee or tax which requires every polluter to pay $X per tonne of pollutant. This charge will vary by pollutant since their damaging effects can vary greatly - it may also vary by location. This is the traditional method proposed by economists, and there is a specific reason for this. Economists are not concerned directly with the level of pollution; they are concerned directly with the damage that it causes, which is then compared with the costs of avoiding that damage.

An economist is satisfied that resources are allocated efficiently when the additional benefit of abatement equals the additional cost of abatement, and any change in the level of pollution would make society worse off. He does not have in mind any preconceived amount of reduction in emissions. In this sense, once the appropriate tax rate is selected, profit-maximizing firms will choose the socially optimal amount of abatement.

Emission discharge fees might not be set at an optimal level, in the sense that the most efficient allocation of resources is achieved. This does not mean, however, that such fees cannot achieve pollution control levels at least as high as CAC levels achieve, or that the costs of control can be reduced by such fees.

The discharge fee approach has several problems. In the first place, calculating the cost of pollution damages is an extremely arduous task. Therefore, choosing the correct tax level is fraught with difficulty. Secondly, non-economists who are concerned with the environment rarely think in these terms; they think in terms of target emissions or deposition levels. It may be that the empirical difficulties and uncertainties of discharge fees make such a quantity-based approach easier, or it may have come about as a result of misguided logic. Whatever the reason, choosing target quantities and using taxes to achieve them results in some additional uncertainty. Since we do not know with precision industry's demand for pollution, we must experiment with tax rates to get

the quantity results that we want. Since the long-run demand for pollution likely differs substantially from the short-run demand, such experimentation might take a long time, during which events may alter the demand for pollution in ways which cannot be predicted. Thus, prices will likely have to be changed continually to achieve the desired quantity. Furthermore, the real value of taxes raised in this way will decline over time, as a result of inflation. They must consequently be adjusted upward every year simply to maintain the level of abatement desired.

There is an obvious solution to this problem, one which meets the requirements of both economists and non-economists, and which is also consistent with the market-based approach to the environment. This is the concept of a marketable emissions permit (MEP). If we wished only 2,000 tonnes of some pollutant to be emitted in any year in Canada, the government would issue 2,000 permits, each of which would allow the owner to emit one tonne of pollutant per year. These would be distributed to Canadians,(3) who could sell and resell them.

Some firms would seek out pollution permits, this being a cheaper alternative than abatement. Others would sell permits, this being more profitable than continuing to pollute and use up permits. Buying and selling permits would determine an equilibrium market price, which would then be the basis upon which abatement decisions were made. If a firm can abate at a marginal cost less than the market price of the permit, it will do so. This firm will not have to buy a permit it does not possess, or it will be able to sell one for a profit. The operations of some companies will be very clean and those of others will be dirty. The key fact is that the latter companies will have to pay for the privilege of having dirty operations by obtaining and paying for MEPs.

The essence of a market-based approach to pollution control, whether based upon discharge fees or MEPs, is its tendency to produce least-cost abatement. Every firm would face an explicit price when it came to the use of the environment as a garbage dump. This price, compared to

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(3) We will discuss the manner of distributing these permits in a later section.

the firm's marginal abatement cost, would determine the level of abatement effort, and in the process, allocate abatement effort throughout the economy. The market would do what a regulator has to do under a CAC system of regulations.

One serious problem with the promotion of economic or market-based instruments is the fact that they work without fanfare and are not viewed as environmental tools. They receive little publicity and little support.

All Canadians are familiar with refundable deposits on soft drink and beer containers. When we purchase these products, we pay a deposit on the container. If the container is returned, the deposit is refunded. This, in effect, imposes a pollution tax on those who dispose of these containers improperly. In Ontario, only about 2% of beer containers are not returned and, thus, are subject to this tax. The blue box recycling program in Canadian cities receives far more publicity and funding, and is touted as an important solution to the garbage problem, yet it will unlikely achieve anywhere near the success rate of the deposit-refund program already in place and which is a perfect example of a market-based tool which works extremely well.

This approach can also be applied to other products with similar disposal problems. Sometimes we have too much garbage because individuals do not dispose of items properly; for example, recycling may be available but a household may not avail itself of this option. Many times, however, disposal costs are high because of the nature of the product.

In cases where the disposal characteristics of consumer products are very evident, it is possible to levy a special sales tax or a special deposit on products which incur particularly high disposal costs.

For example, automobile and truck tires create such serious disposal problems that the former Minister of Environment for the province of Quebec, the Hon. Clifford Lincoln, announced he was considering a special tax on their sales and the province of Ontario has already levied a $5/tire tax.

If the problem with tires is simply that they tend to be discarded haphazardly, creating a littering problem, the government could

require that a deposit be paid with the purchase of each tire. When the useful life of the tire has expired, the consumer's deposit (which should be high enough to promote compliance) would be refunded if the tire was returned to an authorized collection station. These collection stations would then be charged with the responsibility of properly disposing of the old tires. As we have seen, we already have such a system for soft drink and beer bottles, and it works.

If the problem with tires is that the disposal cost is high, then it is appropriate for the consumers to pay this by means of an environmental sales tax. If we also have the problem of littering, a practical solution would be to levy a deposit upon purchase, part of which would be refundable, as described above and part of which would not be refundable and would therefore constitute an environmental sales tax.

An environmental sales tax need not only provide funds for proper disposal, it can spur the development and use of cleaner alternatives. For example, disposable diapers constitute a major problem for municipal landfill sites. Parents use them because they are convenient, effective, and their cost is competitive with that of alternatives, such as diaper services. But parents do not pay the full cost for their use because they do not pay the full marginal cost of disposal. An appropriate sales tax would place the burden of garbage costs on those who generate them; more importantly, it would alter relative prices and create a spur to the use of alternatives. These two everyday examples (tires and diapers) demonstrate the role that households can play in determining the use of the environment.

Such a tax could be applied to other environmental problems. The new federal government standards for automobile emissions may not be sufficiently stringent in the future. A special sales tax, applicable not to the value of the car but to its rated level of emissions, could be applied to all new cars. Such a tax could also be applied to production, for example, to users of industrial chemicals. The tax, in both its refundable and non-refundable form, would apply in this instance.

There are at present few cases where the clean and dirty alternatives are so clear. As the appropriate environment departments

develop more expertise in this area, however, they could apply this sales tax to more and more products. The logic on which it is based is clear: to raise the price of dirty products and to decrease the relative price of clean products. Households, while being rational consumers, will at the same time be doing the environment a favour.

It might be argued that such a sales tax would not work because the producers of taxable products might reduce the prices of their products so as not to be at a price disadvantage with clean products. Since their own profits would, as a result, decline, however, it is not unreasonable to expect that they would try as hard as possible to avoid such action. Whether the sales tax works at the level of the consumer or that of the producer, it would reduce the demand for dirty products and increase the incentive for firms to develop and supply cleaner ones.

An alternative to taxing specific products could be a tax on total waste production. Such a scheme would in fact be more sensible and efficient but it would have higher monitoring and compliance costs than a tax on products with specific disposal problems.

B. Distribution

One reason why businesses prefer CAC types of regulation is that, under such a regime, a firm must pay for the abatement required to get down to the allowable level of emission, but any emissions lower than that are free. Under a system of discharge fees or MEPs, a firm pays to employ the technology to reduce emissions to its chosen level, but it must still pay for the pollution that it continues to emit. The transfer of money to the government can be very great under a system of discharge permits or fees.

Marketable emissions permits can be distributed in a number of ways. They can be auctioned off freely. The distribution of permits will likely mimic the ultimate distribution with little trading taking place, but all the benefits of trading still occurring. Firms will buy the number of permits that they think they will need, and only if they are proven wrong or if circumstances change, will there be a need for trades.

Auctioning in this fashion generates a large revenue flow to governments. Each permit could have a fixed and finite life, say five years. After that period ended, a new set of permits would be auctioned.

One real advantage of an auction is that no competitive advantage is given to a particular group of firms. MEPs constitute valuable rights. Some firms may be given MEPs free of charge, giving them a competitive advantage over those who must pay for these permits. Many of the MEP programs in existence do allocate permits free of charge to existing polluters, in recognition that some property rights to the status quo do exist.

Although there are very real wealth effects as a result of the initial distribution of MEPs, this is irrelevant to the final outcome in terms of pollution levels. What matters from the point of view of an efficient allocation of resources is the marginal impact of this system on corporate decisions. If the initial distribution of permits through auction or free distribution is inappropriate to the needs of firms, it can be altered through trading.

C. Objections and Responses

Market-based pollution controls constitute a relatively novel approach to pollution control and thus are viewed with suspicion by many. The following attempts to address some of the objections such controls face and compare their workings to those of a CAC system.

1. It Won't Work

Under what circumstances might we get more pollution than we desire under a system of MEPs? Obviously, this would happen if we initially established too many permits, but this kind of error can occur with almost any type of regulatory regime. The process that goes into the determination of the aggregate amount of MEPs is the same, and requires the same information and study as the establishment of aggregate limits under a command and control system of regulations.

Indeed, one particular advantage of the MEP is that any issue of too many permits can be easily rectified. If the government,

after having issued 2,000 tonnes worth of permits, decided the number should be instead 1,500 tonnes, it need only go to the market and buy 500 tonnes. If environmental groups felt that 2,000 tonnes was excessive, and they had the support of the public, they need only establish a fund-raising campaign and buy up permits themselves. In the short run, environmental groups and their supporters would effectively pay for greater abatement through the purchase of MEPs; but such a move would send a very clear signal to governments that the public was in favour of tighter controls and that industry could live with them. It is likely that, as a consequence, the government would issue fewer permits in the next round.

Discharge fees which result in too little abatement can also be adjusted easily by an appropriate rate increase.

2. Firms Might Cheat

Any policy which imposes pollution abatement costs on firms generates incentives to cheat. That is why a system of monitoring and fines is needed to ensure that the system works. This is true of CAC systems, emissions charges and MEPs. It is essential that fines for non-compliance be at least as high as the costs of compliance so that firms in breach of environmental regulation gain no financial benefit.

The MEP does add one possible complication, however. The distribution of emissions will change over time as trades take place. A central registry for the MEP must accurately keep track of these rights and the extent to which they have been used up through the year. Essentially, the government would want to ensure that a firm did not sell emissions rights that it had already used up. Since many of the benefits of an MEP come about from the possibility of trading, the government might wish to ensure that the legal responsibility for such false trades rests with the seller and not the buyer. In this way, firms would be less hesitant about buying credits from others.

3. Firms Will Buy Permits Rather Than Reduce Emissions

For some firms, it would be less costly to continue polluting and use MEPs, but there would be a fixed number of MEPs. If the

number of permits allowed less than the current level of emissions, abatement must take place somewhere in the system. If the initial price of permits was low in relation to aggregate abatement costs, there would be an excess demand for permits which would drive up the price; eventually, this higher price would influence firms' decisions about whether to abate or not.

The same argument can be made with respect to effluent fees. Unfortunately, however, there is no aggregate limit to come to their defence, but there is a profit motive which comes into play. A firm paying $100 to discharge pollutants that it could control for less would suffer the same fate as a firm which buys excessively priced raw materials, labour or capital. It would operate under a competitive disadvantage and either alter its ways or go out of business.

4. Firms Will Use MEPs as Speculative or Predatory Tools

As very few firms can operate without producing any pollutants, it is conceivable that some rich individual or firm could drive all competitors out of business by depriving them of MEPs.

The threat of predatory competition exists in all markets, yet it seems to have no long-lasting effects. Would it be any different with MEPs? The answer is a resounding no! A firm can eliminate its domestic competition; but as long as foreign competition exists, it cannot guarantee market share, and this is what really counts. Moreover, specific pollutants are produced in a wide variety of industries. For Falconbridge, for example, to drive INCO out of business, it would have to buy all MEPs associated with SO_2. In the process, it would also have to drive out of business non-competitors, such as electricity producers, natural gas processing plants, tar sands plants, etc. Surely, this would be an expensive and inefficient means of besting one's competitors.

There are a variety of circumstances in which firms might use MEPs as predatory devices.(4) Most markets, however, contain enough competitive elements to make such use unlikely.

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(4) W.S. Misiolek and H.W. Elder, "Exclusionary Manipulation of Markets for Pollution Rights," Journal of Environmental Economics and Management, Vol. 16, No. 2, March 1989, p. 156-66.

But could a firm purchase MEPs for purely speculative reasons? The answer is, of course, yes. Is this a bad thing? The answer is no.

Assume that a rich individual wished to speculate in SO_2 MEPs, and further assume that this individual did not need these MEPs for production purposes because he himself generated no SO_2. If he bought these permits and tried to sell them at a price which exceeded the market price, say $600 per tonne rather than $400 per tonne, firms needing additional permits would base their abatement decisions on the $600 price charged by the speculator or the price at which any other producer was willing to resell permits, likely to be some amount higher than $400.

If the speculator was successful in driving up the price of permits above the market clearing price, some permits would go unused. With the demand for permits being a negative function of price, any increase in price would lead to a decrease in the aggregate amount of pollution. The effect would be the same as if an environmental group bought some permits and held them off the market. The environment would get cleaner and the speculator would become in effect, if not in intent, an environmentalist.

5. Some Firms Must Abate While Others Could Just Buy MEPs

The CAC type of regulation links the "polluter pays principle" with abatement effort; in other words, firms "pay" only to the extent that they engage in pollution control. In such a case, it might seem fair to allocate abatement effort equally among firms, even though uniform reductions will likely impose a great variety of costs on different firms. With a market-based system, the polluter pays principle holds. Under a CAC system, the "polluter doesn't pay principle" tends to hold.

Under a market-based system of control, the MEP or emissions tax, this linkage is broken. Firms which engage in no pollution control whatsoever must still pay, by either paying the emissions tax or purchasing the appropriate amount of MEPs.

6. CAC Regulations are Better at Promoting New Technology

Consider the case where a government wishes to reduce some large amount of pollutants dramatically, say by two-thirds, without knowing how industry would achieve this. It has been suggested that a very tough CAC type of system actually fosters innovation in pollution control technology. Indeed, the United States EPA has introduced regulations in the past, while knowing that the technology to meet the new standards did not yet exist.

There are certain conditions under which firms using MEPs might engage in less pollution control research and development than they would under a CAC system.(5) This is primarily because other, more cost-efficient, means of controlling pollution, such as trading, exist with MEPs. And it should be remembered that technological innovation is not the goal of environmental policies, it is only one means of achieving such goals.

Despite the argument made above, it is still likely that an MEP or effluent fee system will foster more technological development than a CAC system. A firm which is operating within its emission limits under a CAC system has no fiscal incentive to lower emissions further. Indeed, it may actually face a disincentive if uniform proportionate cuts in the future are imposed on existing emissions levels. A firm operating under a market-based system of controls always faces a positive price for each unit of emissions. Whether it is a large or small polluter, the firm can always save some money if it can find an inexpensive way to cut emissions further.

7. MEPs are Regionally Insensitive

If we institute a system of MEPs, should we allow one tonne of pollutant in Manitoba to be traded for one tonne of pollutant in Newfoundland? Could the system through such trades create local pollution problems where none existed before?

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(5) D.A. Malueg, "Emission Credit Trading and the Incentive to Adopt New Pollution Abatement Technology," Journal of Environmental Economics and Management, Vol. 16, No. 1, January 1989, p. 52-57.

The flexibility of a system of MEPs does create the potential for problems that do not plague other systems, but this should not be overstated. For example, we know that one tonne of SO_2 emitted from point A and falling on a sensitive ecosystem, is more damaging than one tonne of SO_2 emitted from point B and falling on a well-buffered ecosystem. A properly structured CAC set of regulations must take this into account, as must a system of emissions fees (by charging a higher per unit tax in the more sensitive area) and as must a system of MEPs.

Specific regions can be established within which trades are allowed, and outside of which they are disallowed. If the regions were small, it is conceivable that few potential traders would be in the same region. Some flexibility could be provided by weighting emissions in each region differently and allowing trades to take place on the basis of these weights. Thus, one tonne of SO_2 emitted in Sudbury might count as three tonnes, so that a three-tonne reduction in Newfoundland is needed to offset a one-tonne increase in Sudbury. Once these ratios were established and known, trading could take place as simply as with one-to-one trades.

STUDIES OF MARKET-BASED SYSTEMS

A. Hypothetical Systems

Instances of market-based pollution control systems are still relatively rare. Economists have, however, undertaken a number of studies to compare the impact of such approaches with that of the present CAC systems. This section reports on some hypothetical cases, while the following section examines some studies of actual systems in place.

A number of studies have examined American CAC regulations and estimated, through the use of simulation models, the cost savings from a market-based system that achieved the same level of pollution abatement.(6) Of 11 air quality studies, all showed potential cost

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(6) T.H. Tietenberg, Emissions Trading: An Exercise in Reforming Pollution Policy, Resources for the Future, Washington, D.C., 1985, p. 41-58.

savings from a market-based system, ranging from a low of 6.5% savings to a high of 95%. In general, these studies show the CAC system to deliver pollution control at excessive cost; exactly the same environmental results could be achieved at lower cost.(7)

Similar potential savings have been shown as available with respect to water quality programs. Three studies show potential cost savings to range from a low of 11% to a high of 68%, with an unweighted average of 45%.(8) As with the air quality studies, there are a variety of reasons why these potential savings might be somewhat overstated, but they do not alter the fact that the studies show consistently that market-based systems are less costly than CAC regulations.

An additional study of water quality standards on four American rivers, the Willamette, Delaware, Mohawk and Upper Hudson, demonstrated that marketable permits systems came close to achieving least cost abatement results, and significantly outperformed conventional CAC programs in terms of cost.(9)

B. Existing Systems

1. MEPs and Variants

a. Fox River, Wisconsin

Since 1981, a system of marketable permits aimed at controlling biological oxygen demand (BOD) has been in effect on this river. It was estimated that such a system had the potential to achieve

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(7) The unweighted average cost saving amounts to 83.6%. Discarding the two cases of extremely large savings still generates an unweighted average cost saving of 70%. See Tietenberg (1985), Table 4.

(8) Tietenberg (1985), Table 5.

(9) J.W. Eheart et al., "Transferable Discharge Permits for Control of BOD: An Overview," in E.F. Joeres and M.H. David, eds., Buying a Better Environment: Cost-Effective Regulation Through Permit Trading, University of Wisconsin Press, Madison, Wisconsin, 1983, p. 163-95.

substantial cost savings. Yet in practice, such has not been the case, and only one "trade" has taken place among firms.(10)

There are several possible reasons for this lack of trades, including the fact that having a limited number of firms creates a "thin" market for permits, and the fact that some of the firms involved are municipal utilities subject to regulation. It is more likely, though, that the problem is due to the high transaction costs this system imposes upon trades. A trade between two parties which reduces only the total costs of pollution is not allowed; a firm must justify its "need" for additional permits, for example, it must be a new entrant or a growing firm. In this sense, the Fox River system does not constitute a real MEP system. The fact that the permits initially distributed had a lifespan of only five years is also thought to have created some uncertainty in the sense that a firm purchasing permits did not know the amount of discharge it would be permitted in the future. This seems, however, to present no more of a problem of uncertainty of supply than the purchase of any other input. Nor is it any worse than an effluent fee, the cost of which is not known five years in the future.

b. Dillon Reservoir, Colorado

This reservoir, which supplies about half of the water used by the city of Denver, is subject to phosphorous discharged by both point and non-point sources. Since 1984, each discharger has been granted an annual allotment of phosphorous which he could use or trade. Trades are allowed only between point and non-point sources, and for every increase in point source emissions of one pound, two pounds of non-point source emissions must be reduced. Since the marginal cost of abatement at point sources is estimated to be seven times as high as the marginal cost at non-point sources, this trading restriction still leaves room for a wide

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(10) R.W. Hahn, "Economic Prescriptions for Environmental Problems: How the Patient Followed the Doctor's Orders," Journal of Economic Perspectives, Vol. 3, No. 2, Spring 1989, p. 95-114; and R.W. Hahn and G.L. Hester, "Marketable Permits: Lessons for Theory and Practice," Ecology Law Quarterly, Vol. 16, No. 2, 1989, p. 361-406.

range of profitable trades.(11) Annual savings from trades have been estimated at $775,000.

c. Lead Trading

When the United States decided to phase out the use of lead in gasoline, it was recognized that refiners had varying capacity to meet the new standards. Generally, the smaller refiners faced the highest costs for reducing their lead levels. Lead permits were initially distributed according to actual production levels and average lead content, and completely free trading was allowed. In 1985 alone, almost half of all refineries participated in trading and about 15% of all lead credits were traded.(12) This is a very high response rate. Total cost savings to refiners are believed to be in excess of $200 million.(13)

d. EPA Bubbles and Offsets

The United States Environmental Protection Agency (EPA) has employed several versions of MEPs for over a decade now. Under the EPA's netting provisions, trades are allowed only among pollution sources within a single firm. What are known as "offset" and "bubble" provisions provide for both internal and external trades.

The number of transactions allowed under these provisions is now several thousand, with the majority of trades still being internal. These innovative rules have allowed firms to meet environmental standards at substantial cost savings. The low estimate of savings totalled just over $1,200 million as of 1985. The upper estimate is about 10 times this figure. And there is no indication that this flexibility has harmed environmental quality in any way.(14)

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(11) Hahn and Hester (1989), p. 395.

(12) Hahn (1989), p. 102.

(13) Hahn and Hester (1989), p. 387.

(14) Hahn (1989), p. 98-101.

e. West Germany

In this country, new sources of pollution cannot enter areas where ambient air quality does not meet certain standards. If, however, an old and dirty plant ceases to operate or is renovated so as to decrease its emissions, its rights to emissions may be allocated to new sources. In this sense, the right to pollute can be traded from one source to another.

2. Emission Charges Systems

a. The Netherlands

A system of effluent charges has been in place in the Netherlands for about two decades. The use of this system, and the prices charged, are far higher in the Netherlands than in France and Germany, two other countries using such an approach to pollution control. Thus, the per capita charges in the Netherlands are about three times as high as those in Germany and about eight times as high as those in France, where the charge is used more to raise revenue than to provide an incentive for pollution control.

The Dutch charges have also increased over time, and this increase has been associated with a decline in emissions. Over a 15-year period, emissions per capita declined by about 90%.(15)

b. West Germany

Effluent charges on wastes dumped into German waters have been in existence for decades. They are generally applied at the local level. In 1981, the revenue from these charges amounted to 350 DM

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(15) The evidence for the Dutch experience comes from three sources cited in Hahn (1989). These are: J. Bressers, "The Effectiveness of Dutch Water Quality Policy," Twente University of Technology, the Netherlands, mimeo, 1983; G. Brown Jr. and J. Bresser, "Evidence Supporting Effluent Charges," Twente University of Technology, Netherlands, mimeo, 1986; and G. Brown Jr., "Economic Instruments: Alternatives or Supplements to Regulation?" Environment and Economics, Issue Paper, Environment Directorate, OECD, June 1984.

million.(16) An interesting feature of the German system is the fact that effluent fees are used in combination with standards for individual firms. A firm which meets its standard faces a unit charge which is one-half as great as a firm which does not meet its standard. The unit charge thus has elements of a non-compliance fine.

c. Italy

The Italian system resembles the one used in Germany. It is based upon discharge and the rate is nine times as high for firms that do not comply with standards as for firms that do.(17)

d. Water Charges in North America

For the most part, industrial sewage and water charges have not mimicked very well the economist's vision of effluent fees. Nevertheless, municipalities now have a long experience with such fees and the statistical evidence does demonstrate that user charges do work. In a study of 35 American cities, it was discovered that a 10% increase in sewage charges leads to an 8% decrease in BOD (biological oxygen demand) causing discharge, while a similar increase in water charges leads to a 4% reduction in water intake. A study of poultry-processing plants found similar results. A 10% increase in BOD charges led to a 5% reduction in discharge while a 10% increase in water rates led to a 6% reduction in water use.(18)

Canadian evidence tends to confirm the American experience. Canadian municipalities also have a tradition of industrial discharge fees. Data collected from the operation of breweries indicates that a 10%

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(16) G.M. Brown Jr. and R.W. Johnson, "Pollution Control by Effluent Charges: It Works in the Federal Republic of Germany, Why Not in the U.S.," Natural Resources Journal, Vol. 24, October 1984, p. 929-66.

(17) OECD, Economic Instruments for Environmental Protection, Paris, 1989, p. 41.

(18) These examples are cited in W.J. Baumol and W.E. Oates, Economics, Environmental Policy, and the Quality of Life, Prentice-Hall Inc., Englewood Cliffs, N.J., 1979, p. 258-59.

increase in discharge fees results in a 5.7% decrease in BOD causing emissions and a 4.5% reduction in suspended solids emissions.(19)

3. Deposit-Refund Systems (20)

Many European nations have long had deposit-refund systems in place for beverage containers. In most cases, the systems work extremely well.

In Finland, over 90% of bottles with deposits are returned. In Norway, the return rate also exceeds 90% for beer and soft drink bottles, while it is only 70% for wine and liquor bottles. In general, the lower the deposit as a percentage of total expenditures, the lower the response.

Similar systems exist for car hulks. In Sweden, where the deposit is low, the system works poorly, whereas in Norway, where the deposit is almost four times the Swedish rate, the return rate exceeds 90%.

The Netherlands is also considering a deposit-refund system for batteries and pesticide containers, both of which pose serious soil contamination problems.

4. Differential Tax Rates

The experience in OECD nations is limited and relatively unsuccessful. Although the idea of increasing the relative prices of polluting products is viewed favourably, it has been suggested that administrative complexity hinders the use of such a tool, particularly in nations where existing sales taxes, especially the Value-Added Tax, are already very complex.(21)

Yet one would expect exactly the opposite to be the case. Since product taxes are widespread, it is simply a matter of identifying

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(19) J.F. Chant et al., "The Economics of a Conserver Society," in W.E. Block, ed., Economics and the Environment: A Reconciliation, The Fraser Institute, Vancouver, 1989, p. 1-93.

(20) OECD (1989), p. 82-87.

(21) Ibid., p. 69-72.

products which pollute and taxing them at a higher rate. The European difficulty is more likely to be due to the availability of lower-taxed polluting products in other jurisdictions. This will likely be exacerbated with the integration of Europe into a common economic unit in 1992.

In Canada, the price of leaded gasoline has traditionally been less than the price of unleaded gasoline, and this is still the case in many provinces. A combination of regulation and tax increases by the governments of Ontario and Canada has reversed this traditional relationship. Today, in Ontario, leaded gasoline sells for about 2¢/litre more than its unleaded counterpart.(22)

The impact on sales of leaded gasoline has been quite telling. In 1987, when leaded gasoline had a price advantage, Ontario sales of regular leaded gasoline were 52% of the sales of regular unleaded gasoline. At the end of 1988, this price advantage was eliminated. For that year, leaded gasoline sales amounted to only 32% of their unleaded counterpart. By the end of 1989, unleaded gasoline had a distinct price advantage. For the entire year, leaded gasoline sales equalled only 13% those of unleaded gasoline.(23)

Differential pricing of leaded and unleaded gasoline has had a dramatic impact on sales of the polluting product, much more so than one could expect from changes in the stock of vehicles able to use leaded gasoline.

CONCLUDING COMMENTS

Pollution is an economic problem flowing from poorly established property rights and, consequently, inappropriately priced

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(22) Energy, Mines and Resources Canada, Petroleum Product Market Report, Issue 37, December 1989. In Toronto, the differential is 2.1¢/litre in December 1989, up 0.5¢ from the previous month. In December 1988, the two were priced the same.

(23) Statistics Canada, Refined Petroleum Products, Cat. No. 45-004, November 1988 and November 1989.

resources. Solutions to pollution problems are based upon establishing environmental prices. Even CAC regulations establish a price, but they do so implicitly. The inefficiency of CAC is due to the way in which these environmental prices are established. As long as a firm generates less pollution than it is allowed under a CAC system, it pays a zero price. At its emissions limit, the firm faces a positive and finite price. Beyond that limit, the firm faces an infinite price, in theory. The inefficiency of the CAC system is due to the fact that it effectively imposes different prices on different polluters, even though the pollution they generate is qualitatively the same.

A market-based system is designed to charge firms and individuals the same price for similar environmental consumption. All polluters must take this price into account when determining their levels of abatement and, consequently, abatement effort will be concentrated in those areas with lowest abatement cost.

The Organisation for Economic Co-operation and Development has recently concluded a large-scale survey of economic instruments for reducing pollution in member countries.(24) Many of these do not meet the criteria of true market-based instruments because they do not alter the system of incentives for households or firms (see Appendix). Where methods do meet these criteria, however, the OECD and other researchers have demonstrated that they can be effective in reducing pollution cost-effectively.

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(24) Organisation for Co-operation and Development, Economic Instruments for Environmental Protection, Paris, 1989.

BIBLIOGRAPHY

Barde, Jean-Philippe. "The Economic Approach to the Environment." The OECD Observer, No. 158, June-July 1989, p. 12-15.

Baumol, W.J. and W.E. Oates. Economics, Environmental Policy, and the Quality of Life. Prentice-Hall Inc., Englewood Cliffs, N.J., 1979.

Baumol, W.J. and W.E. Oates. The Theory of Environmental Policy. 2nd Edition. Cambridge University Press, Cambridge, 1988.

Blinder, A.S. Hard Heads, Soft Hearts: Tough-Minded Economics for a Just Society. Addison-Wesley Publishing Co. Inc., Reading, Mass., 1988.

Block, W.E., ed. Economics and the Environment: A Reconciliation. The Fraser Institute, Vancouver, 1989.

Brown, Jr., G.M. and R.W. Johnson. "Pollution Control by Effluent Charges: It Works in the Federal Republic of Germany, Why Not in the U.S." Natural Resources Journal, Vol. 24, October 1984, p. 929-66.

R.W. Crandall. Controlling Industrial Pollution: The Economics and Politics of Clean Air. The Brookings Institute, Washington, D.C., 1983.

Hahn, R.W. "Economic Prescriptions to Environmental Problems: How the Patient Followed the Doctor's Orders." Journal of Economic Perspectives, No. 2, Spring 1989, p. 95-114.

Hahn, R.W. and G.L. Hester. "Marketable Permits: Theory and Practice." Ecology Law Quarterly, Vol. 16, No. 2, 1989, p. 361-406.

Joeres, E.F. and M.H. David, eds. Buying a Better Environment: Cost-Effective Regulation Through Permit Trading. University of Wisconsin Press, Madison, Wisconsin, 1983.

Malueg, D.A. "Emission Credit Trading and the Incentive to Adopt New Pollution Abatement Technology." Journal of Environmental Economics and Management, Vol. 16, No. 1, January 1989, p. 52-57.

Misiolek, W.S. and H.W. Elder. "Exclusionary Manipulation of Markets for Pollution Rights." Journal of Environmental Economics and Management, Vol. 16, No. 2, March 1989, p. 156-66.

Organisation for Economic Co-operation and Development. Economic Instruments for Environmental Protection. Paris, 1989.

Rhoads, S.E. The Economist's View of the World: Government, Markets and Public Policy. Cambridge University Press, Cambridge, 1986.

Tietenberg, T.H. Environmental and Natural Resource Economics. Scott Foresman and Company, Glenview, Illinois, 1984.

Tietenberg, T.H. Emissions Trading: An Exercise in Reforming Pollution Policy. Resources for the Future Inc., Washington, D.C., 1985.

World Commission on Environment and Development. Our Common Future. Oxford University Press, Oxford, 1987.

APPENDIX

THE INTENDED AND ACTUAL IMPACTS OF POLLUTION-RELATED CHARGES

Purpose:	Incentive	Incentive	Financial	Financial
Practice:	Incentive	Financial	Financial	Incentive
Effluent Charges				
Air		France		
Water	Germany	Italy	France	Netherlands
Waste	Denmark	Belgium	United States	
Aircraft Noise			France	
			Germany	
			Japan	
			Netherlands	
			Switzerland	
			United Kingdom	
Industrial Noise			Netherlands	
User Charges			All countries	
Product Charges				
Lubricants			Finland	
			France	
			Germany	
			Italy	
			Netherlands	
Mineral oil and products		Norway	Finland	
			Netherlands	
			Sweden	
Beverage containers	Finland	Sweden[1]		
Food containers	Norway			
Batteries		Sweden[1]		
Fertilizers		Sweden[1]		
Pesticides		Sweden[1]		
Feedstock			United States	
Administrative Charges				
Waste			Belgium	
Pesticides	Sweden		Denmark	
			Finland	
Chemicals	Sweden			
Tax differentiation	All countries			

1. These Swedish product charges have a stated financial purpose as well.

Source: Organisation for Co-operation and Development, Economic Instruments for Environmental Protection, Paris, 1989, p. 73.

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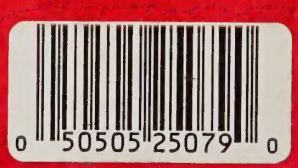
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